



## General Semiconductor



### SMA (DO-214AC)

Cathode

Anode



(unidirectional)



(bidirectional)

### Surface-Mount



- Package: SMA plastic package.
- Lead Finish: Matte Tin
- Case Material: Epoxy Molding Compound.
- UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020



**Description**

SMAJ Series transient voltage suppressors are excellent overvoltage protective devices. The Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

**Features**

- Excellent clamping capability
- Low leakage current
- Low capacitance
- High surge capability
- Glass passivated chip
- Epoxy resin package
- Built-in strain relief
- Will not fatigue
- RoHS Compliant
- Fast response time: typically less than 1.0ps from 0 Volts to VBR min

**Mechanical Characteristics**

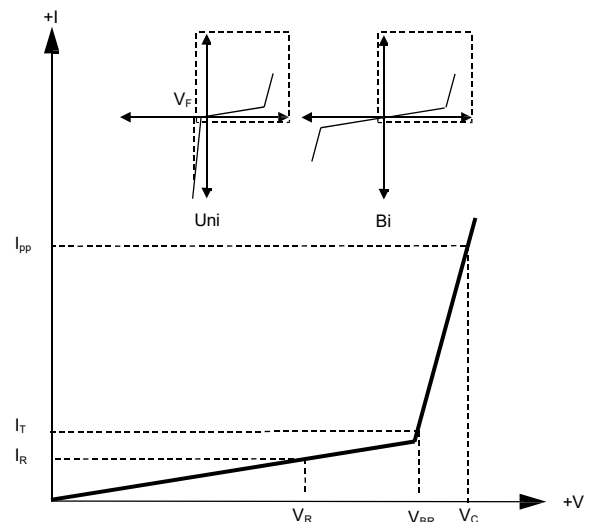
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**Applications**

- Telecom
- Computer
- Industrial electronic
- Consumer electronic

**Electrical Parameters**

| Parameter | Definition   |
|-----------|--|
| $C_J$     | Junction Capacitance - typical capacitance measured with 0V or $V_R$ bias                                      |
| $I_{PP}$  | Peak Pulse Current - maximum rated peak impulse current  |
| $V_C$     | Clamping Voltage - Peak voltage measured across the suppressor at a specified $I_{ppm}$ (peak impulse current) |
| $V_{BR}$  | Breakdown Voltage - Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )           |
| $I_R$     | Leakage Current - maximum peak off-state current measured at $V_R$   |
| $V_R$     | Peak Off-state Voltage - maximum voltage that can be applied while maintaining off state                       |



**Summary of Packing Options**

| Package | Packing Description | Packing Quantity | Industry Standard |
|---------|---------------------|------------------|-------------------|
| SMA     | Tape/Reel, 11" reel | 5000             | EIA-481-1         |
|         | Tape/Reel, 7" reel  | 2000             | EIA-481-1         |

**SMA(DO-214AC)**



**Absolute Maximum Ratings (TA=25°C unless otherwise noted)**

| Parameter                                      | Symbol           | Value      | Units | Remarks        |
|--|------------------|------------|-------|----------------|
| Peak Pulse Power Dissipation                   | P <sub>PPM</sub> | 400        | W     | (Note1)(Note2) |
| Steady State Power Dissipation                 | P <sub>D</sub>   | 3.3        | W     | (Note3)        |
| Peak Forward Surge Current                     | I <sub>FSM</sub> | 40         | A     | (Note4)        |
| Maximum Instantaneous Forward Voltage at 20A   | V <sub>FM</sub>  | 3.5/6.5    | V     | (Note5)        |
| Typical Thermal Resistance Junction to Lead    | R <sub>θJL</sub> |            | °C/W  |                |
| Typical Thermal Resistance Junction to Ambient | R <sub>θJA</sub> | 120        | °C/W  |                |
| Operating Temperature Range                    | T <sub>J</sub>   | -55 to 150 | °C    |                |
| Storage Temperature Range                      | T <sub>STG</sub> | -55 to 150 |       |                |
| Maximum junction capacitance                   | C                | 1500       | PF    |                |

Notes1: Non-repetitive current pulse , 10/1000us Waveform.

Notes2: Mounted on copper pad area of 5x5mm to each terminal.

Notes3: Infinite HeatSink at TA=50°C

Notes4: Measured on 8.3ms single half sine wave or equivalent square wave, duty cycle=4 perminute maximum.

Notes5: For UnidirectionalOnly, V<sub>FM</sub><3.5V for V<sub>BR</sub> ≤200V and V<sub>FM</sub><5.0V for V<sub>BR</sub> ≥201V.

**Electrical Characteristics (TA=25°C unless otherwise noted)**

| Part Number (Uni) | Part Number (Bi) | Marking Code |    | Reverse Stand off Voltage V <sub>R</sub> (V) | Breakdown Voltage V <sub>BR</sub> @ I <sub>T</sub> (V) |      | Test Current I <sub>T</sub> (mA) | Maximum Clamping Voltage V <sub>C</sub> @ I <sub>PP</sub> (V) | Maximum Peak Pulse Current I <sub>PP</sub> (A) | Maximum Reverse Leakage I <sub>R</sub> @ V <sub>R</sub> (μA) |
|-------------------|------------------|--------------|----|--|--|------|----------------------------------|---|--|--|
|                   |                  | Uni          | Bi |  | Min  | Max  |                                  |   |  |  |
| SMAJ5.0A          | SMAJ5.0CA        | AE           | WE | 5  | 6.4  | 7    | 10                               | 9.2   | 43.5   | 800  |
| SMAJ6.0A          | SMAJ6.0CA        | AG           | WG | 6  | 6.67   | 7.37 | 10                               | 10.3  | 38.8   | 800  |
| SMAJ6.5A          | SMAJ6.5CA        | AK           | WK | 6.5  | 7.22   | 7.98 | 10                               | 11.2  | 35.7   | 500  |
| SMAJ7.0A          | SMAJ7.0CA        | AM           | WM | 7  | 7.78   | 8.6  | 10                               | 12  | 33.3   | 200  |
| SMAJ7.5A          | SMAJ7.5CA        | AP           | WP | 7.5  | 8.33   | 9.21 | 1                                | 12.9  | 31   | 100  |
| SMAJ8.0A          | SMAJ8.0CA        | AR           | WR | 8  | 8.89   | 9.83 | 1                                | 13.6  | 29.4   | 50   |
| SMAJ8.5A          | SMAJ8.5CA        | AT           | WT | 8.5  | 9.44   | 10.4 | 1                                | 14.4  | 27.8   | 20   |
| SMAJ9.0A          | SMAJ9.0CA        | AV           | WV | 9  | 10   | 11.1 | 1                                | 15.4  | 26   | 10   |
| SMAJ10A           | SMAJ10CA         | AX           | WX | 10   | 11.1   | 12.3 | 1                                | 17  | 23.5   | 5  |
| SMAJ11A           | SMAJ11CA         | AZ           | WZ | 11   | 12.2   | 13.5 | 1                                | 18.2  | 22   | 1  |
| SMAJ12A           | SMAJ12CA         | BE           | XE | 12   | 13.3   | 14.7 | 1                                | 19.9  | 20.1   | 1  |
| SMAJ13A           | SMAJ13CA         | BG           | XG | 13   | 14.4   | 15.9 | 1                                | 21.5  | 18.6   | 1  |
| SMAJ14A           | SMAJ14CA         | BK           | XK | 14   | 15.6   | 17.2 | 1                                | 23.2  | 17.2   | 1  |
| SMAJ15A           | SMAJ15CA         | BM           | XM | 15   | 16.7   | 18.5 | 1                                | 24.4  | 16.4   | 1  |
| SMAJ16A           | SMAJ16CA         | BP           | XP | 16   | 17.8   | 19.7 | 1                                | 26  | 15.4   | 1  |
| SMAJ17A           | SMAJ17CA         | BR           | XR | 17   | 18.9   | 20.9 | 1                                | 27.6  | 14.5   | 1  |
| SMAJ18A           | SMAJ18CA         | BT           | XT | 18   | 20   | 22.1 | 1                                | 29.2  | 13.7   | 1  |
| SMAJ20A           | SMAJ20CA         | BV           | XV | 20   | 22.2   | 24.5 | 1                                | 32.4  | 12.3   | 1  |



Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)

| Part Number (Uni) | Part Number (Bi) | Marking Code |    | Reverse Stand off Voltage $V_R$ (V) | Breakdown Voltage $V_{BR} @ I_T$ (V) |      | Test Current $I_T$ (mA) | Maximum Clamping Voltage $V_C @ I_{PP}$ (V) | Maximum Peak Pulse Current $I_{PP}$ (A) | Maximum Reverse Leakage $I_R @ V_R$ ( $\mu\text{A}$ ) |
|-------------------|------------------|--------------|----|-------------------------------------|--------------------------------------|------|-------------------------|---|---|---|
|                   |                  | Uni          | Bi |                                     | Min                                  | Max  |                         |   |   |   |
| SMAJ22A           | SMAJ22CA         | BX           | XX | 22                                  | 24.4                                 | 26.9 | 1                       | 35.5  | 11.3                                    | 1   |
| SMAJ24A           | SMAJ24CA         | BZ           | XZ | 24                                  | 26.7                                 | 29.5 | 1                       | 38.9  | 10.3                                    | 1   |
| SMAJ26A           | SMAJ26CA         | CE           | YE | 26                                  | 28.9                                 | 31.9 | 1                       | 42.1  | 9.5                                     | 1   |
| SMAJ28A           | SMAJ28CA         | CG           | YG | 28                                  | 31.1                                 | 34.4 | 1                       | 45.4  | 8.8                                     | 1   |
| SMAJ30A           | SMAJ30CA         | CK           | YK | 30                                  | 33.3                                 | 36.8 | 1                       | 48.4  | 8.3                                     | 1   |
| SMAJ33A           | SMAJ33CA         | CM           | YM | 33                                  | 36.7                                 | 40.6 | 1                       | 53.3  | 7.5                                     | 1   |
| SMAJ36A           | SMAJ36CA         | CP           | YP | 36                                  | 40                                   | 44.2 | 1                       | 58.1  | 6.9                                     | 1   |
| SMAJ40A           | SMAJ40CA         | CR           | YR | 40                                  | 44.4                                 | 49.1 | 1                       | 64.5  | 6.2                                     | 1   |
| SMAJ43A           | SMAJ43CA         | CT           | YT | 43                                  | 47.8                                 | 52.8 | 1                       | 69.4  | 5.8                                     | 1   |
| SMAJ45A           | SMAJ45CA         | CV           | YV | 45                                  | 50                                   | 55.3 | 1                       | 72.7  | 5.5                                     | 1   |
| SMAJ48A           | SMAJ48CA         | CX           | YX | 48                                  | 53.3                                 | 58.9 | 1                       | 77.4  | 5.2                                     | 1   |
| SMAJ51A           | SMAJ51CA         | CZ           | YZ | 51                                  | 56.7                                 | 62.7 | 1                       | 82.4  | 4.9                                     | 1   |
| SMAJ54A           | SMAJ54CA         | RE           | ZE | 54                                  | 60                                   | 66.3 | 1                       | 87.1  | 4.6                                     | 1   |
| SMAJ58A           | SMAJ58CA         | RG           | ZG | 58                                  | 64.4                                 | 71.2 | 1                       | 93.6  | 4.3                                     | 1   |
| SMAJ60A           | SMAJ60CA         | RK           | ZK | 60                                  | 66.7                                 | 73.7 | 1                       | 96.8  | 4.1                                     | 1   |
| SMAJ64A           | SMAJ64CA         | RM           | ZM | 64                                  | 71.1                                 | 78.6 | 1                       | 103   | 3.9                                     | 1   |
| SMAJ70A           | SMAJ70CA         | RP           | ZP | 70                                  | 77.8                                 | 86   | 1                       | 113   | 3.5                                     | 1   |
| SMAJ75A           | SMAJ75CA         | RR           | ZR | 75                                  | 83.3                                 | 92.1 | 1                       | 121   | 3.3                                     | 1   |
| SMAJ78A           | SMAJ78CA         | RT           | ZT | 78                                  | 86.7                                 | 95.8 | 1                       | 126   | 3.2                                     | 1   |
| SMAJ85A           | SMAJ85CA         | RV           | ZV | 85                                  | 94.4                                 | 104  | 1                       | 137   | 2.9                                     | 1   |
| SMAJ90A           | SMAJ90CA         | RX           | ZX | 90                                  | 100                                  | 111  | 1                       | 146   | 2.7                                     | 1   |
| SMAJ100A          | SMAJ100CA        | RZ           | ZZ | 100                                 | 111                                  | 123  | 1                       | 162   | 2.5                                     | 1   |
| SMAJ110A          | SMAJ110CA        | SE           | VE | 110                                 | 122                                  | 135  | 1                       | 177   | 2.3                                     | 1   |
| SMAJ120A          | SMAJ120CA        | SG           | VG | 120                                 | 133                                  | 147  | 1                       | 193   | 2.1                                     | 1   |
| SMAJ130A          | SMAJ130CA        | SK           | VK | 130                                 | 144                                  | 159  | 1                       | 209   | 1.9                                     | 1   |
| SMAJ150A          | SMAJ150CA        | SM           | VM | 150                                 | 167                                  | 185  | 1                       | 243   | 1.6                                     | 1   |
| SMAJ160A          | SMAJ160CA        | SP           | VP | 160                                 | 178                                  | 197  | 1                       | 259   | 1.5                                     | 1   |
| SMAJ170A          | SMAJ170CA        | SR           | VR | 170                                 | 189                                  | 209  | 1                       | 275   | 1.5                                     | 1   |
| SMAJ180A          | SMAJ180CA        | ST           | VT | 180                                 | 201                                  | 222  | 1                       | 292   | 1.4                                     | 1   |
| SMAJ200A          | SMAJ200CA        | SV           | VV | 200                                 | 224                                  | 247  | 1                       | 324   | 1.2                                     | 1   |
| SMAJ220A          | SMAJ220CA        | SX           | VX | 220                                 | 246                                  | 272  | 1                       | 356   | 1.1                                     | 1   |
| SMAJ250A          | SMAJ250CA        | SZ           | VZ | 250                                 | 279                                  | 309  | 1                       | 405   | 1                                       | 1   |
| SMAJ300A          | SMAJ300CA        | TE           | UE | 300                                 | 335                                  | 371  | 1                       | 486   | 0.8                                     | 1   |
| SMAJ350A          | SMAJ350CA        | TG           | UG | 350                                 | 391                                  | 432  | 1                       | 567   | 0.7                                     | 1   |
| SMAJ400A          | SMAJ400CA        | TK           | UK | 400                                 | 447                                  | 494  | 1                       | 648   | 0.6                                     | 1   |
| SMAJ440A          | SMAJ440CA        | TM           | UM | 440                                 | 492                                  | 543  | 1                       | 713   | 0.6                                     | 1   |



Rating And Characteristic Curves (TA=25°C unless otherwise noted)



Fig.1 - Peak Pulse Power Rating



Fig.2 - Pulse Derating Curve



Fig.3 - Pulse Waveform



Fig.4 - Typical Junction Capacitance



Fig.5 - Steady State Power Dissipation Derating Curve



Fig.6 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only



Package Dimensions



| SMA       |        |       |       |             |      |       |
|-----------|--------|-------|-------|-------------|------|-------|
| Dimension | Inches |       |       | Millimeters |      |       |
|           | MIN    | NOM   | MAX   | MIN         | NOM  | MAX   |
| A         | 0.1    |       | 0.11  | 2.54        |      | 2.8   |
| B         | 0.194  |       | 0.223 | 4.93        |      | 5.66  |
| C         | 0.051  |       | 0.067 | 1.3         |      | 1.7   |
| D         | 0.157  |       | 0.177 | 3.99        |      | 4.5   |
| F         | 0.006  |       | 0.012 | 0.152       |      | 0.305 |
| G         | -      |       | 0.008 | -           |      | 0.203 |
| H         | 0.078  |       | 0.095 | 1.98        |      | 2.42  |
| L         | 0.03   |       | 0.06  | 0.76        |      | 1.52  |
| X         |        | 0.085 |       |             | 2.16 |       |
| Y         |        | 0.07  |       |             | 1.78 |       |
| Z         |        | 0.079 |       |             | 2    |       |



Soldering Parameters



| Reflow Condition                                       |                                    | Lead-free assembly      |
|--|------------------------------------|-------------------------|
| Pre Heat   | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|  | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|  | - Time (min to max) ( $t_s$ )      | 60 – 180 secs           |
| Average ramp up rate (Liquidus Temp ( $T_L$ ) to peak) |                                    | 3°C/second max          |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                   |                                    | 3°C/second max          |
| Reflow   | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|  | - Time ( $t_L$ )                   | 60 – 150 secs           |
| Peak Temperature ( $T_P$ )                             |                                    | 260 <sup>+0/-5</sup> °C |
| Time within 5°C of actual peak Temperature ( $t_p$ )   |                                    | 20 – 40 secs            |
| Ramp-down Rate   |                                    | 6°C/second max          |
| Time 25°C to peak Temperature (t)                      |                                    | 8 minutes Max.          |
| Do not exceed  |                                    | 260°C                   |



**Tape and Reel Specification**



| Dimension | Inches |       |     | Millimeters |       |     |
|-----------|--------|-------|-----|-------------|-------|-----|
|           | MIN    | NOM   | MAX | MIN         | NOM   | MAX |
| P         |        | 0.157 |     |             | 4     |     |
| P0        |        | 0.157 |     |             | 4     |     |
| W         |        | 0.472 |     |             | 12    |     |
| W1        |        | 0.492 |     |             | 12.5  |     |
| D1        |        | 7     |     |             | 177.8 |     |
| D2        |        | 11    |     |             | 279.4 |     |



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